CLAIMS

What is claimed is:

1. A beam structure comprising:

a semiconductor substrate;

a trench extending into the semiconductor substrate, the trench having walls;

a first conducting layer positioned over the walls of the trench at selected locations; and

a beam positioned with the trench, the beam being connected at a first portion thereof to the substrate and being movable at a second portion thereof, the second portion being spaced from the walls of the trench by a selected distance.

2. The beam structure in claim 1, further comprising a remaining sacrificial layer between the first portion of the beam and the first conducting layer.

3. The beam structure in claim 2 wherein the remaining sacrificial layer comprises an oxide layer.

4. The beam structure in claim 1 wherein the beam is a cantilever beam.

5. The beam structure in claim 1, further comprising a first dielectric layer between the trench and the first conducting layer.

6. The beam structure in claim 5 wherein the first dielectric layer comprises a dual layer of a nitride layer formed on an oxide layer.

7. The beam structure in claim 1, further comprising a second dielectric layer on the beam.

8. The beam structure in claim 1 wherein the beam comprises a second conducting layer and a beam material layer.

9. The beam structure in claim 8 wherein the beam material layer comprises a doped polysilicon layer.

10. The beam structure in claim 8 wherein the second conducting layer comprises a metal layer selected from the group of tungsten, titanium, tantalum, and aluminum.

11. The beam structure in claim 1 wherein the first conducting layer comprises a metal layer selected from the group of tungsten, titanium, tantalum, and aluminum.

12. The beam structure in claim 11 wherein the first conducting layer further comprises a doped polysilicon layer.

13. A semiconductor structure comprising:

a semiconductor substrate;

a first trench extending in a first direction, the first trench having walls;

a second trench extending in a second direction, the second trench having walls;

a first conducting layer positioned over the walls of the first and the second trenches at selected locations;

a first beam positioned with the first trench, the first beam being connected at a first portion thereof to the substrate and being movable at a second portion thereof,

the second portion being spaced from the walls of the first trench by a selected distance; and

a second beam positioned with the second trench, the second beam being connected at a first portion thereof to the substrate and being movable at a second portion thereof, the second portion being spaced from the walls of the second trench by a selected distance.

14. The semiconductor structure in claim 13 wherein the length of the first beam is different from the length of the second beam.

15. The semiconductor structure in claim 13 wherein the width of the first beam is different from the width of the second beam.

16. The semiconductor structure in claim 13 wherein the width of the first trench is different from the width of the second trench.

17. The semiconductor structure in claim 13 wherein the thickness of the first beam is different from the thickness of the second beam.

18. The semiconductor structure in claim 13 wherein the first direction is parallel to the second direction.

19. The semiconductor structure in claim 13 wherein the first direction is perpendicular to the second direction.

20. The semiconductor structure in claim 13 wherein the first direction and the second direction are in an arrangement so that the first trench and the second trench have a common radius from a common point.

21. The semiconductor structure in claim 20 wherein the first beam is perpendicular to a first line extending from the center of a circle and the second beam is perpendicular to a second line extending from the center of the same circle.

22. The semiconductor structure in claim 20 wherein the first beam is parallel to and on a first line extending from the center of a circle and the second beam is parallel to and on a second line extending from the center of the same circle.

23. The semiconductor structure in claim 13, further comprising a first dielectric layer between the first trench and the first conducting layer, and between the second trench and the first conducting layer.

24. The semiconductor structure in claim 13, further comprising a first remaining sacrificial layer between the first portion of the first beam and the first conducting layer, and between the first portion of the second beam and the first conducting layer.

25. An integrated circuit on a semiconductor substrate comprising:

a sensor including:

a trench extending from a first surface into the substrate, the trench having walls,

a first conducting layer positioned over the walls of the trench at selected locations, and

a beam positioned with the trench, the beam being connected at a first portion thereof to the substrate and being movable at a second portion thereof, the second portion being spaced from the walls by a selected distance; and

a semiconductor circuit on the substrate having a first node coupled to the first conducting layer and a second node coupled to the beam layer.

26. The integrated circuit in claim 23 wherein the sensor further comprises a first dielectric layer between the trench and the first conducting layer.

27. The integrated circuit in claim 23 wherein the sensor further comprises a remaining sacrificial layer between the first portion of the beam and the first conducting layer.

28. A method comprising:

forming a trench in a semiconductor substrate;

forming a first conducting layer on the walls of the trench;

forming a sacrificial layer on the first conducting layer;

forming a beam on the sacrificial layer; and

removing a portion of the sacrificial layer so that a first portion of the beam remains coupled to a remaining portion of the sacrificial layer and a second portion of the beam is movable and spaced from the walls by a selected distance.

29. The method in claim 26 wherein the step of forming a beam comprises:

forming a second conducting layer on the sacrificial layer; and

forming a beam material layer on the second conducting layer.

30. The method in claim 26, further comprising: forming a first dielectric layer between the trench and the first conducting layer.

31. The method in claim 26, further comprising:

forming a second dielectric layer on the beam.

32. The method in claim 26, further comprising:

applying an acceleration force to the substrate so as to deflect the beam to electrically contact with the wall of the trench.

33. The method in claim 26, further comprising:

applying a temperature variation from a first temperature to a second temperature to the substrate so as to deflect the beam to electrically contact with the wall of the trench.

34. A semiconductor structure comprising:

a semiconductor substrate;

a first trench extending in a first direction, the first trench having walls;

a second trench extending in a second direction, perpendicular to the first direction, the second trench having walls;

a first conducting layer positioned over the walls of the first and the second trenches at selected locations;

a first beam positioned with the first trench, the first beam being connected at a first portion thereof to the substrate and being movable at a second portion thereof, the second portion being spaced from the walls of the first trench by a selected distance;

a second beam positioned with the second trench, the second beam being connected at a first portion thereof to the substrate and being movable at a second portion thereof, the second portion being spaced from the walls of the second trench by a selected distance; and

a third beam that is parallel to the surface of the semiconductor substrate having its primary axis of motion perpendicular to the surface of the substrate.

35. The semiconductor structure in claim 34 wherein the length of the first beam is the same as the length of the second beam.

36. The semiconductor structure in claim 34 wherein the width of the first beam is the same as the width of the second beam.

37. The semiconductor structure in claim 34 wherein the width of the first trench is the same as the width of the second trench.

38. The semiconductor structure in claim 34 wherein the thickness of the first beam is the same as the thickness of the second beam.

39. The semiconductor structure in claim 34 wherein the length of the first beam is the different from the length of the third beam.

40. The semiconductor structure in claim 34 wherein the width of the first beam is the different from the width of the third beam.

41. The semiconductor structure in claim 34 wherein the thickness of the first beam is the different from the thickness of the third beam.

42. The semiconductor structure in claim 34 wherein the third beam is built in a third trench.

43. The semiconductor structure in claim 42 wherein the width of the first trench is different from the width of the third trench.

44. The semiconductor structure in claim 42 wherein the depth of the first trench is different from the depth of the third trench.